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Shrub Seedling Regeneration After Controlled Burning and Herbicidal Treatment of Dense Pringle Manzanita Chaparral¹

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Planned burning during periods of relatively low fire hazard has been suggested as a means of managing dense chaparral stands for fire hazard reduction, game and livestock range improvement, and increased water yields. While the major components of shrub live oak-mountainmahogany chaparral in Arizona reproduce largely by sprouting, a number of shrubs associated with dense stands of Pringle manzanita reproduce only by seed. Some plants, of course, reproduce both by seeds and sprouts.

Planned burning of a dense community of Pringle manzanita (fig. 1) in October 1962 provided an opportunity to observe shrub seedling establishment and survival under different treatment and burn conditions.

The study area, known as the "El Oso Block Burn," lies in the Mazatzal Mountains of the Tonto National Forest in central Arizona. The area generally faces northerly, at an elevation of 5,500 feet. Soil is coarse but moderately deep. Parent material is deeply weathered Pre-Cambrian granite. Average annual rainfall is estimated at 22.50 inches. From October 1, 1962 to September 30, 1963, 23.56 inches of precipitation fell; 13.25 inches



Figure 1.--A dense manzanita community in the Mazatzal Mountains before controlled burn. Dominant shrub is Pringle manzanita, with only minor amounts of shrub live oak and desert ceanothus. Yerba-santa was absent from the mature stand.

in October through May, 10.31 inches in June through September.

To improve flammability during the fall, the shrubs were sprayed by helicopter with 4 pounds per acre of the butoxyethanol ester of 2,4-D in a 1-to-5 diesel oil-water emulsion in

¹See table 1 for botanical names of shrubs.

²Plant Ecologist, located at Tempe, in cooperation with Arizona State University; central headquarters are maintained at Fort Collins, in cooperation with Colorado State University.

August 1962. One 30-acre area was sprayed and burned, one 10-acre area was sprayed but not burned, and a 30-acre area was unsprayed and unburned. Spraying alone killed an estimated 90 percent or more of the Pringle manzanita tops; as this species does not sprout, this represents a high degree of control. After burning was completed, all three areas were seeded to weeping lovegrass (*Eragrostis curvula* (Schr.) Nees) and sand dropseed (*Sporobolus cryptandrus* (Torr.) A. Gray). Shrub seedling counts were made in early spring 1964, approximately 1 year after germination (table 1).

Number of shrub seedlings appeared highly correlated with intensity of burn, with virtually no seedlings of either shrubs or grasses on the "sprayed unburned" or "check" areas.

The dense stand of yerba-santa seedlings, over 100,000 per acre, deserves special mention. Careful examination of the area before burning revealed no living plants or identifiable dead remnants within the manzanita community. A few plants were noted along the cutbanks of a forest road penetrating the stand, but these had given no indication of spreading. The manzanita community was al-

Table 1. --Surviving 1-year-old shrub seedlings¹ on El Oso Block Burn, Tonto National Forest, Arizona, spring 1964

Botanical and common names of species		Burned in October 1962		Unburned	
		Intense burn ²	Light burn ³	Spray only	Check
- - - - - Number per acre - - - - -					
<i>Arctostaphylos pringlei</i> Parry	Pringle manzanita	18,180	4,363	0	0
<i>Ceanothus greggii</i> A. Gray	Desert ceanothus	2,618	636	0	0
<i>C. integerrimus</i> Hook. & Arn.	Deerbrush	190	0	0	0
<i>Cercocarpus montanus</i> Raf.	True mountainmahogany	95	0	0	0
<i>Eriodictyon angustifolium</i> Nutt.	Yerba-santa	101,293	16,453	0	0
<i>Garrya flavescens</i> S. Wats.	Yellowleaf silktassel	571	1,182	0	59
<i>Quercus emoryi</i> Torr.	Emory oak	143	364	0	11 ⁸
<i>Q. turbinella</i> Greene	Shrub live oak	48	91	0	0

¹Oaks germinated in August 1963; all others, March-April 1963.

²Leaves and twigs mostly consumed.

³Shrubs dead but leaves and small twigs mostly intact; largely a "cool" or "ground" fire.

most literally "closed." As yerba-santa seeds are of moderately high density and not winged, one must conclude that they were stored in the soil, perhaps for many years. This conclusion is supported by the findings of Glendening and Pase.³

Increased germination of soil-stored shrub seeds has been reported by Gratkowski⁴ and Horton and Kraebel.⁵

Occasional remnants of long-dead plants of desert ceanothus were found in the stand before it was burned, while deerbrush was apparently absent. Seedlings of these species

undoubtedly came from seed stored in the soil. The heavy acorns of Emory oak and shrub live oak were probably planted by pin-yon jays or rodents on the burned areas. The light, plumose seeds of true mountainmahogany could well have been windborn from adjacent unburned areas where it was abundant.

Additional seedlings germinated the second spring after the burn. In order of abundance, these were Pringle manzanita, desert ceanothus, and yellowleaf silktassel. No new seedlings of yerba-santa were noted the second spring; however, separation of seedlings and the abundant root sprouts of this species made identification uncertain.

In conclusion, the use of fire to break up stands of mature Pringle manzanita may result in a great increase in seedlings of less desirable species, which may be in part offset by an increase in certain shrubs that are highly desirable as game forage. Additional control techniques to improve the composition of replacement vegetation are badly needed before fire is widely used in such areas.

³Glendening, George E., and Pase, C. P. Effect of litter treatment on germination of species found under manzanita (*Arctostaphylos*). Jour. Range Managt. 17: 265-266. 1964.

⁴Gratkowski, H. Brush seedlings after controlled burning of brushlands in southwestern Oregon. Jour. Forestry 59: 885-888. 1961.

⁵Horton, J. S., and Kraebel, C. J. Development of vegetation after fire in the chamise chaparral of southern California. Ecology 36: 244-262. 1955.